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ABSTRACT

A two-year interinstitutional study among 15 cooperating universities was conducted to determine whether significant differences exist in teaching loads among the selected universities as measured by student credit hours produced by full-time equivalent faculty. The statistical model was a multivariate analysis of variance with fixed effects and utilizing a factorial arrangement of treatments, with pre-planned orthogonal contrasts incorporated. The results indicated that the main effects of institution and division were each highly significant at the .0001 level, as were the multivariate interaction and the year effect. The orthogonal contrasts were based on the division by institution interaction: however, some partial confounding was present due to missing cells. Differences in teaching load were concluded to follow from one or more of the following factors: size of institution, competitiveness of surrounding institutions, overall student/faculty ratio, faculty salaries, yearly changes, and other miscellaneous factors. (Author/PHR)

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An Interinstitutional Analysis of Faculty Teaching Load

by

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ABSTRACT

Studies indicate that faculty salaries represent sixty to eighty percent of an institution of higher education's operating budget and that teaching load accounts for two-thirds of the total faculty effort. This study concerns itself with a university's largest budgeted resource: faculty, and more specifically, faculty teaching load. It is based on a two-year interinstitutional data exchange among fifteen cooperating universities in an attempt to determine whether or not significant differences exist in teaching loads among selected universities as measured by student credit hours produced by full-time equivalent faculty. The statistical model incorporated into the study was a multivariate analysis of variance with fixed effects and utilizing a factorial arrangement of treatments. Pre-planned orthogonal contrasts were incorporated into the model. The results indicated that the main effects of institution and division were each highly significant at the .0001 level, as was the multivariate interaction and the year effect. The orthogonal contrasts were based on the division by institution interaction, however, some partial confounding was present due to missing cells. Whereas this study produced empirical results which indicate some similarity among universities, perhaps the real contribution of this study is in the overall methodology and interpretation of the results which easily lend to modeling by other institutions contemplating interinstitutional analysis.

With the impending decline in college enrollments causing cutbacks in college and university programs throughout the nation, the foreseeable need for examining and analysing the allocation of faculty resources within an institution becomes increasingly more significant.

In a memorandum to all vice-chancellors and academic deans dated April 17, 1975, Chancellor Paul Murrill of Louisiana State University (Baton Rouge) stated the following: "... if a faculty member has a lower than normal teaching load in a particular department, appropriate justification therefore should be briefly stated."

Chancellors and presidents of universities are not the only ones seeking justification for teaching loads. Considering that there are over 750,000 faculty in the nation's 2,500 universities, and, as faculty salaries represent 60 to 80 percent of an institution's operating budget (Romney, 1971), and because teaching load accounts for two-thirds of the total faculty effort, there is a growing concern for public accountability to the taxpayer (Romney and Manning, 1974). Speaking at the annual conference of the American Association for Higher Education, Kerr (1971) stated the following:

> Cost-effectiveness of operations will be more carefully examined. If this is not done internally, it will be done externally by the "new experts" working for legislatures and governors.

This study is an example of the "internally done" research to which Kerr makes reference. While only concentrating on one aspect of faculty workload (i.e., teaching load), the research reported in this study represents an initial step in quantitatively measuring faculty teaching load both within and between institutions of higher education.

Specifically, the study attempted to determine whether a differentiation existed among universities as to teaching loads of ranked faculty based on an artificial grouping of academic structures (i.e., divisions by two digit Higher Education General Information Survey (HEGIS) code) with the dependent measure being the number of student credit hours produced during the fall semester per full-time equivalent faculty (SCH/FTE). For example, an administrator might make note of the fact that a typical Music professor only produces 100 SCH's per semester, whereas the average production in the History department is over six hundred SCH's per professor per semester. Making note of this fact, the administrator might then want to compare the disparity in teaching loads with the teaching loads of other similar institutions to determine if this difference is constant among other universities (i.e., does the aforementioned 100 to 600 ratio exist among other universities as well).

Although this study was concerned mostly with ranked faculty (i.e., instructors, assistant professors, associate professors and professors), total faculty (the aforementioned plus lecturer, and graduate teaching assistants) was also considered. It was not, however, given equal emphasis in the analysis, and it was used mostly for interpreting the differences in ranked faculty if, indeed, there were any.

The significance of this study lies not only in the empirical results, but also in the overall methodology used in the study and the manner in

which the results of this study were interpreted. The techniques and interpretations lend themselves to modeling by other institutions contemplating interinstitutional analysis.

REVIEW OF RELATED LITERATURE

Beginning with the first study of faculty workload of major significance published in 1919 by Koos (Yuker, 1974), there have been hundreds of articles published and studies conducted concerning faculty as a resource (Hesseldenz, 1976).

From the late 1950's up until the present, there have been numerous studies conducted by individual institutions. The most publicized of these include the Ohio Study (1970) which reviewed over one hundred studies and included a rather comprehensive survey of faculty resource analyses (Romney, 1971). The University of California (1970) study was designed to show differences among disciplines within a university.

In 1959, a two-day conference was held at Purdue University on faculty workload. The papers presented at this conference were published by Bunnell (1960). This monograph included several important papers: methods of analyzing faculty workload by Stecklein (1960), uses of faculty load data in interinstitutional analysis by Blee (1960), and an extensive bibliography of faculty load by Stickler (1960).

Throughout the 1960's and 1970's many outside environmental factors have influenced the studies of faculty workload and interinstitutional analysis. Peterson (1976: viii) cited some of the following sources of outside pressure: desegregation, affirmative action, consumerism, collective bargaining, and accountability.

The recent rise of national agencies such as the National Center for Educational Statistics (NCES) and the National Center for Higher Education Management Systems (NCHEMS) has been predominant in aiding interinstitutional analysis (Peterson, 1976).

At the same time, the federal government, particularly through the Higher Education Facilities Act of 1963 and the subsequent general higher education support programs, gave added impetus to the formation of state coordinating agencies (Dressel, 1974). The organization of the Higher Education General Information Survey clarified the need for uniform, consistent, and compatible systems of reporting data through the states to the federal level (Drews and Drews, 1969).

Concommitant with the emergence of environmental factors and national agencies, there has also been increasing emphasis by state agencies and professional associations on reporting interinstitutional data on faculty workloads.

METHODOLGY

At the annual meeting of the Southern University Group of 25 (SUG) held in Atlanta, Georgia, in October of 1975, it was decided that cooperating universities within the group would exchange data on faculty teaching load and that the Louisiana State University System would serve as the host institution for the data exchange. It was from this two-year data exchange that this study received its data.

The following institutions participated in the data exchange: Texas A & M (Bryan), University of Alabama (Birmingham), Louisiana State University

then forwarded to the participating institutions with instructions on how to prepare them. The completed load sheets were then returned to LSU to be coded and subsequently punched onto IBM cards. Printouts of the raw data were generated on the computer and sent to the participants for editing. Following the edit procedure, the data were then converted to magnetic tape and made available to the participants. The SUG data exchange was an informal operation and, as such, no information or analytical reports were prepared by the SUG group per se; instead, such reports were left to the individual institutions to prepare if they so desired. It should be noted that the data only represents the teaching load as reflected on the fall semester census date of a particular institution for a given year.

The statistical model used in the analysis was a two-factor multivariate analysis of variance with fixed effects and utilized a factorial arrangement of treatments. Appropriate least squares adjustments were incorporated into the analysis as there were some missing observations within the cells. Pre-planned orthogonal comparisons were also included in the study in an attempt to isolate significant differences.

RESULTS

The basic data used in the study were reported in the form of student credit hours (SCHs) and by full-time equivalent faculty (FTE). The SCHs were reported by student level as broken out by individual HEGIS codes; whereas, the FTE was broken out by HEGIS codes, it was not reported by student level, but by ranked, other, and total. From these basic data, the dependent variable, student credit hours per full-time equivalent faculty member (SCH/FTE), was calculated.

(Baton Rouge), University of Kentucky (Lexington), University of South Carolina (Columbia), Virginia Polytechnic Institute (Blackburg), University of Tennessee (Knoxville), North Carolina State (Raleigh), University of New Orleans, University of Texas (Austin), University of Alabama (Tuscaloosa), University of Arkansas (Fayetteville), West Virginia University (Morgantown), Mississippi State University (Starkville), and Florida State University (Tallahassee).

From the aforementioned institutions only five institutions were used in the study and the others were excluded for the following reasons: incompatability of data reported as quarter hours with semester hours; inconsistency of data reported over a two-year period; data reported for only one year (minimum of two years data needed to calculate means for the analysis); and the data were reported in terms too general to be of use to this study (e.g., FTE faculty was not broken down by ranked, other, and total). The sample for this study consisted of five participating universities in the data exchange who must remain anonymous due to the confidentiality of the exchanged information. Individual institutional data are distinguished only through the use of numeric codes (e.g., Institution One, Two, etc.).

The general operating procedure used throughout the study was as such. Participants in the study were first identified and then definitions were determined. Next, load sheets and credit enrollment forms were designed for the tabulation of the data to be used in the exchange.[1] These forms were

[1] Examples of load sheets and credit enrollment forms, as well as, sample printouts are available from the authors at the following address: 4025 Tonawanda Drive, Des Moines, Iowa 50312.

Table 1 shows the results for the testing of the null hypothesis of no significant differences using a multivariate analysis of variance technique employing the two dependent measures of SCH/RFTE and SCH/TFTE as the criteria with the independent variables being institution, division, and the division by institution interaction; and the block effect being year.

TABLE 1. Multivariate Analysis of Variance With the Two Dimensional Criterion Variable of SCH/RFTE and SCH/TFTE

Source of Variation	df	F[1]
Institution	8/166	8.61**
Division	34/166	12.39**
Division x Institution	136/166	4.65**
Year	2/82	6.61**

** P < .01

[1] Pillai's Trace used in F approximations

The results found in Table 1 confirm the univariate ANOVA's generated for the dependent variable SCH/RFTE. The main effects of institution and division were each highly significant at the .0001 alpha level, as was the multivariate interaction and the year effect.

Unlike many classical statistical studies, where rejection of the null hypothesis in favor of the alternative hypothesis was sought, this was not the case in this study. It was hypothesized that few differences would be found among the institutions studied, as this would develop a case for comparability and possible norming procedures for faculty teaching loads across the divisions by institutions.

Based on this premise, orthogonal comparisons were planned, in the hope that significant differences could be isolated among the various divisions.

The orthogonal contrasts were performed on the division by institution interaction. Table 2 shows the table of multipliers used in the analysis. These comparisons were repeated for each degree of freedom associated with the interaction and the main effect of institution and with a single comparison associated with each degree of freedom; hence, the interaction effect was subdivided into an additive sums of squares associated with each comparison.

TABLE 2. Orthogonal Multipliers and Comparisons Made

Comparison	Inst. 1	Inst. 2	Inst. 3	Inst. 4	Inst. 5
1,2 vs 3,4,5	1.5	1.5	-1	-1	-1
1 vs 2	1	-1	0	0	0
3 vs 4,5	0	0	2	-1	-1
4 vs 5	0	0	0	+1	-1

Note that the sum of the multipliers for each comparison is equal to zero and that the sum of the cross products is also equal to zero and thus, the comparisons are orthogonal.

The comparisons were used in an attempt to find out if a particular pattern or trend of faculty teaching load could be isolated among selected institutions. The first comparison compared the flagship campuses of two large university systems which competed with an almost identical amount of public and private colleges and universities within their respective states for students, with three other institutions that varied greatly with the number of other institutions that they had to compete with for students in their respective states. Institutions One and Two were located in states which had average faculty salaries among the lowest of all states (NCHEMS, 1977) and both of these universities had the lowest student/faculty ratios in both the 1974-75 and 1972-73 school years.

The second comparison followed naturally as it compared Institutions One and Two. Given similarities in faculty salaries, and competitiveness with surrounding institutions, teaching loads among these universities when compared across divisions should not be significantly different.

The third comparison hypothesized no significant differences when Institution Three was compared with Institutions Four and Five. Albeit, none of the institutions contained within this study had programs that were singled out as being in the top twenty by the Carnegie Commission on Higher Education (Mayhew, 1973), Institution Three is better known to the academic community for its technical programs in Agriculture

and Engineering, whereas, Institutions Four and Five (and also One and Two) would be considered more eclectic in scope and mission.

Whereas, the fourth comparison was set (i.e., no other comparison could have been made and still maintained orthogonality), it compared two institutions sharing the highest average faculty salaries.

Table 3 summarizes the multivariate and univariate results for the orthogonal comparisons. The four comparisons listed in Table 1 were repeated for each divisional level making a total of seventy-two possible comparisons, however, due to missing cells, only sixty-six comparisons were made.

Of the sixty-six comparisons made (see Table 3 for an overview of the multivariate results) in the multivariate mode, three comparisons showed a significant difference at the .05 level and seventeen comparisons showed significant differences that were considered highly significant ($p < .01$). Only Architecture (0200), Business (0500), Fine Arts (1000), Home Economics (1300), and Library Science (1600) showed no significant differences when treated as multivariate. Only one statistically significant difference was found in the following HEGIS groups: Education (0800), Engineering (0900), Psychology (2000), Public Affairs (2100), and Social Sciences (2200) all $p < .01$; whereas, Foreign Languages (1100) also had only one significant difference, however, the probability of the associated F ratio was .05.

Only Mathematics (1700) was significantly different ($p < .01$) in all four comparisons and only Letters (1500s) was significantly different in as many as three comparisons ($p < .01$). The two combined to account for 41.68 percent of the total sums of squares associated with the

interaction.

These findings are indicative of an emergent pattern of differences in faculty teaching loads. It would appear that the large numbers of survey courses required of all students, as in Mathematics and English, show large differences in teaching loads; whereas, courses taught in divisions with limited enrollments have similar teaching loads when compared to the other institutions.

In the first comparison (1,2,vs. 3,4,5) 33 percent of the comparisons were considered as significantly different ($p < .01$) indicating differences in faculty teaching loads in the following divisions: Agriculture (0100), Life Sciences (0400), Computer Science (0700), Foreign Languages (1100, $p < .05$), Letters (1500), and Mathematics (1700).

In the second comparison (1 vs. 2), 44 percent of the comparisons were significantly different ($p < .05$) indicating that the presupposition of equality of teaching loads between Institutions One and Two was not well founded, this would also help to explain why comparison one (1, 2 vs. 3,4,5) turned up as many significant differences as it did. Table 3 is provided for a ready reference to the significantly different comparisons. Common differences existed in the first two comparisons in the following: Life Sciences (0400), English (1500), and Mathematics (1700). This suggests that the liberal arts and science type institutions not only differ when compared to other institutions in the arts and sciences but, also, that they differ among themselves in the arts and sciences faculty teaching load.

The third comparison (3 vs. 4,5) had a 28 percent rate in the significant differences ($p < .05$) by divisions. As in the first two comparisons,

TABLE 3. Summary of Significantly Different Orthogonal Comparisons

HEGIS Group		Comparison 1: Inst's 1 & 2 vs Inst's 3,4,5	Comparison 2: Inst 1 vs Inst 2	Comparison 3: Inst 3 vs Inst's 4,5	Comparison 4: Inst 4 vs Inst 5
0100[2]	Agriculture	**	*	**	
0200	Architecture				
0400	Life Sciences	**	**		
0500	Business				
0600	Communications				
0700[3]	Computer Science	**			
0800	Education			**	
0900	Engineering			**	
1000[3]	Fine Arts				
1100	Foreign Languages	*			
1300[3]	Home Economics				
1500	Letters	**	**		**
1600[4]	Library Science				
1700	Mathematics	**	**	**	**
1900	Physical Sciences		**	*	
2000	Psychology		**		
2100	Public Affairs		**		
2200	Social Studies		**		

* $p<.05$
** $p<.01$

[2]Adjusted for missing cell from University One

[3]Adjusted for missing cell from University Three

[4]Adjusted for missing cells from both Universities One and Three

no real pattern emerged in the differences.

Comparison 4 (4 vs. 5) had only two significant differences ($p < .01$) occur overall. This is indicative of highly correlated teaching loads between the two universities.

Partial confounding was present in the comparisons due to missing cells in the analysis. Whereas, seventy-two comparisons could have been made, four for each division, only sixty-six were made due to six missing cells.

CONCLUSIONS

It was found that faculty teaching loads differed from institution to institution, from division to division, and from divisional counterparts to divisional counterparts, and that, teaching load was not constant over the years. Whereas all these differences were highly significant ($p < .01$), it should be recognized that the tested means were only based on two years data. It is recommended that at least four to five years data be used in calculating the means, as given a more-or-less fixed sample standard deviation, the standard error of the mean could be made smaller by increasing the size of the sample. However, within the limitations of the study, one or more or some combination of the factors listed herein may attribute to the differences in teaching loads.

a. Size of Institution. The smallest university in terms of student enrollment had the largest overall SCH/RFTE production; however, the largest of the universities studied did not have the lowest overall SCH/RFTE differences in teaching loads was not, however, appreciably affected. This would indicate that the five universities included in this study, used their teaching assistants in a similar manner or that the use of teaching assistants in the calculation of the SCH/TFTE ratio was of minor importance. The latter was not the case in this study as teaching assistants accounted for an average of 22.8 percent of the Total FTE.

b. Competitiveness of Surrounding Institutions. When institutions of similar competitiveness with surrounding institutions were compared with each other, significant differences were found among the two. As a

factor in teaching load differentiation, this is inconclusive for the two institutions should have been similar if competitiveness with surrounding institutions was a factor.

c. Overall Student Faculty Ratio. The two schools most similar in this respect, were found to differ significantly in overall teaching load in a majority of the divisional levels. Once again, this is inconclusive for if the overall student faculty ratio were a factor then the two schools should have been more similar in their divisional teaching loads.

d. Faculty Salaries. Same as b and c above.

e. Yearly Changes. Results from the analysis of variance suggest that faculty teaching loads may also vary on a year to year basis. It is suspected that if more than two years data were used in a similar study, that annual changes in faculty teaching loads would be less appreciably affected.

f. Other. Other sources of variation not investigated in this study might be: similarities in scope and mission; funding of programs; state legislation; and errors made in collection, collation and tabulation of the credit enrollment forms by individual institutions.

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